IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,

Plaintiff,

vs. 4:05-CV-00329-TCK-SAJ

TYSON FOODS, INC., et al,

Defendants.

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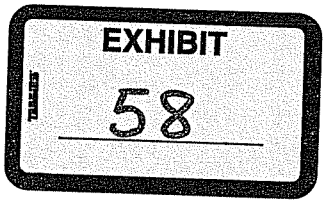
VOLUME I OF THE VIDEOTAPED DEPOSITION OF INDRAJEET CHAUBEY, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 27th day of January, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.



A No.
Q Have you performed any consulting work for the State of Oklahoma in the past?
A No.
Q Have you been retained to provide an opinion about the State of Oklahoma experts' opinions? 09:00AM
A No.
Q Have you been retained to consult with any of the State's experts on any issue in this case?
A No. 09:01AM
Q Have you been retained by anyone to provide opinions as to the defendants' experts' opinions?
A No.
Q Other than coming to testify today in Tulsa, have you been asked by me or others for the State of Oklahoma to do any work on this case? 09:01AM
A No.
Q Other than your coming today to testify, have you been asked by me or others for the State of Oklahoma to form any opinions specifically in connection with this case? 09:01AM
A No.
Q Let's talk a little bit about you, Dr. Chaubey. I'm going to hand you what is Exhibit No. 1. I'll represent to you that this is a document 09:02AM

that I downloaded from the Purdue University, which appears to be, at least in part, a curriculum vitae. Would you agree with that?

A Yes.

Q And is this -- is the data that's on this maintained by you or under your direction? 09:02AM

A Under my direction.

Q Okay. Is the -- let's talk a little bit about -- first off, do you believe this is a full and complete curriculum vitae for you? 09:02AM

A This is not complete particularly. It only partially presents my work.

Q I'm going to ask some questions to give you an opportunity to kind of supplement some of the things on this. All right? 09:02AM

A Okay.

Q Let's start first with your degrees. You have the degrees listed here, and I'm going to take them in reverse order. Tell the court and the witnesses here, what is your bachelors of science degree in? 09:03AM

A My bachelors of science degree is in agricultural engineering.

Q And when did you obtain that degree?

A In 1991.

Q And at what university did you obtain that? 09:03AM

A It was from University of Allahabad in India.
Q Now, you've obtained a masters degree also. It's in biological and agricultural engineering. Where did you obtain that?
A At University of Arkansas. 09:03AM
Q And what year was that?
A 1994.
Q All right. Did you have a supervisor in your masters thesis work at that university?
A Yes. 09:03AM
Q Who was that?
A Dr. Dwayne Edwards.
Q Is he also known as D. R. Edwards?
A Yes.
Q All right. What was the thesis that you -- 09:04AM general subject matter of the thesis that you provided for your masters?
A I investigated how filter strips or buffer strips can be used as a best management practice to filter some of the water quality constituents from 09:04AM land-applied poultry litter and swine manure.
Q All right. You then obtained a PhD. Where was that obtained?
A Oklahoma State University.
Q And what was the degree obtained there? 09:04AM

A Biosystems engineering.
Q And what year was that degree obtained?
A 1997.
Q Did you have a thesis captain or director in your work there? 09:04AM
A Yes.
Q Who was that?
A It was Dr. C. T. Hahn.
Q What was the general subject of the thesis that you prepared for your doctorate? 09:05AM
A It was in the area of hydrology and watershed modeling. I investigated how different uncertainties relate to model inputs and parameters.
Q Okay. Let's talk a little bit about the awards and honors you have listed here. There are 09:05AM several, but are these all of the ones that you have obtained?
A No. Actually, what I consider the most significant is not listed here.
Q What is the award or honor that is significant 09:05AM to you that's not listed?
A It is New Holland Young Researcher Award. It is given by American Society of Agricultural and Biological Engineering to one researcher every year younger than 40 years old. 09:05AM

Q So what was the year of that?
A It was 2007.
Q And what is your age today?
A 40.
Q 40. Are there any other awards or honors you wish to list that aren't otherwise listed on Exhibit 1? 09:06AM
A No. The rest are.
Q Let's talk a little bit about your professional experiences. Other than those listed on this curriculum vitae, are there some omitted? Let me rephrase that. Are there other professional experiences that you think should be added to this that were not on it at the time this was prepared? 09:06AM
A I am involved in some committees and assignments at Purdue which are not listed here. For example, I am on a steering committee of ecological sciences and engineering, and I am a founding member of equivalent to board of directors on division of environmental and ecological engineering at Purdue. 09:07AM
Q All right. Are there any others?
A No. Rest of the significant ones are listed here.
Q All right. This particular document doesn't 09:07AM

have a listing for professional associations. Can you tell the court and jury what those may be?

A I am a member of American Society of Agricultural and Biological Engineering. I am also a member of American Water Resources Association, and two honor societies. One is Gamma Sigma Delta. It's honor society in agriculture, and second one is Alpha Epsilon, honor society in agricultural and biological engineering. 09:07AM

Q Are there any others that you can think of that you would wish to list today that aren't on this Exhibit 1? 09:07AM

A Not really.

Q All right. Exhibit 1 does not list all of your publications, does it? 09:08AM

A No, it does not.

Q All right. Let me hand you what's marked as Exhibit No. 2, and I would represent to you this is another download that I obtained from the website there at Purdue. Can you identify this document for the court, please? 09:08AM

A Yes. It is from my website. It is a list of my publications, presentations, seminars, research reports and other similar documents.

Q In looking at this list yesterday, did you 09:08AM

A About 35 percent is forest. So that's about 90 percent, and rest are in other categories.

Q All right. Do you know what the approximate percentage of the urban area is in the Illinois River watershed? 09:28AM

A So it has to be less than 10 I would think. More like 6 or 7 percent; no more than that.

Q Based on your knowledge and skill and education, training and experience, including reading published literature, do you have an opinion 09:28AM what is the primary method used for poultry waste disposal?

MS. LONGWELL: Object to form.

A Yes.

Q What is that opinion? 09:28AM

A Land application, surface application of poultry litter.

Q All right. From your review of published literature, do you have any knowledge of approximately how long land application of poultry 09:29AM waste has occurred in the IRW?

MS. LONGWELL: Object to form.

A Can you ask that question again?

Q I will. From your review of literature or other sources, do you have knowledge of 09:29AM

approximately how long poultry waste has been generally land applied in the IRW?

MS. LONGWELL: I'm just going to state a continuing objection to the term waste. I think that's traditional, but that way I'm not going to continue to object just because you use that word. 09:29AM

MR. GARREN: All right.

A Yes.

Q Approximately how long have you learned that would be? 09:29AM

A For a long time. I mean, since poultry industry has been concentrated in northwest Arkansas.

Q All right. When I use the term waste, let me maybe define that so that you and I have an understanding, too. I define waste as the excrement, the bedding material and things such as feathers or wasted feed and moisture that occurs that's taken out of the house at the conclusion of the growing session, sometimes commonly referred to as poultry litter in Arkansas. Do you know the term poultry litter? 09:29AM 09:30AM

A Yes.

Q And can you tell me what you understand the term poultry litter would mean? 09:30AM

question.

Q Based upon your personal experience, your observations, including your training and reading of published literature, do you have any idea or opinion about how far waste is generally taken from the poultry barn to be land applied? 09:32AM

MR. GEORGE: Same objection.

MS. LONGWELL: Object to form.

A Yes.

Q Tell us what you know. 09:32AM

A My understanding is that it does not travel too far. Economically it's not viable to transport poultry litter beyond a few kilometers from where it's generated.

Q With regard to that poultry litter or waste, in your study and in your investigations revolving around BMPs and water quality, is it important to know when poultry waste is land applied? 09:32AM

MS. LONGWELL: Object to form.

A Yes. 09:32AM

Q And in your work in the IRW, have you learned from either personal experience, observation or published literature, when poultry waste is generally applied, when it is? What time of year is my question. 09:33AM

Arkansas Cooperative Extension Service, parens, CES, end parens, only about 5 percent of the ration fed to the cattle in northwest Arkansas is from off-farm sources. I believe the first sentence says, and perhaps to put it in context, the impact of unconfined cattle on water quality has not been thoroughly researched in Arkansas as that of confined animal manure management. I really kind of butchered this. I'm reading these all out of order. Let me start over. There's actually three sentences there that put this in context. Let me start over, Dr. Chaubey, and I apologize. 09:54AM 09:55AM

Reading the first sentence again, the impact of unconfined cattle on water quality has not been thoroughly researched in Arkansas as that of confined animal manure management. It then says, according to the University of Arkansas Cooperative Extension Service, CES, only about 5 percent of the ration fed to cattle in northwest Arkansas is from off-farm sources; therefore, it may be safe to assume that pastured cattle do not contribute heavily to the nutrient mass balance of the watershed. Can you tell me what that means? 09:55AM 09:55AM

A What we meant was because there is not a lot of import of nutrients coming to feed the cattle in 09:56AM

the watershed which are grazing, they are primarily recycling the nutrients within the watershed.

Q Okay. I'm going to change subjects on you a little bit now. When you were at the Arkansas Water Resource Center -- 09:56AM

A Can we take a real quick break?

Q We can take a break.

MR. GARREN: We're going off the Record for just a second and we'll be back shortly.

(Following a short recess at 9:56 p.m., 09:56AM proceedings continued on the Record at 10:02 a.m.)

Q Dr. Chaubey, when you were in the Arkansas Water Resource Center working with them, did you have an opportunity to do any work called or referred to as mass balance? 10:02AM

A Yes.

Q Tell the court, basically what does mass balance mean?

A Mass balance involves -- basically it's similar to balancing your checkbook, what comes in 10:03AM and what goes out, and the difference is how much gets accumulated. So we were doing that in the context of nutrients, how much nutrients are getting in the watershed, how much are getting out and then what gets accumulated. 10:03AM

A So if the total numbers that you measure at Highway 59 bridge does not change, if that stayed the same, then percentage of point source contribution would decrease and percentage of non-point source contribution would increase, but if the numbers go down similarly, then you may have to look at that data. 10:41AM

Q Okay. In your professional experience and review of published literature, are you aware of any published paper that contradicts the findings and conclusions shown in Exhibit 8? 10:41AM

MS. LONGWELL: Object to form.

A No.

Q Based on the numbers on Table 2, Page 6 that you talked about earlier, the 1.8 million kilograms in 1997 versus the total input of 3.1 million kilograms, and based upon your knowledge, skill and education and training, including review of published literature, do you have an opinion whether poultry production practices of land applying waste is a substantial contributor of the phosphorus to the overall phosphorus loads within the watershed? 10:42AM 10:43AM

MS. LONGWELL: Object to form.

MR. GEORGE: Object to form, vague, calls for an expert opinion that's not been found by this 10:43AM

witness.
A Yes.
Q And what would be that opinion?
MR. GEORGE: Same objection.
A Based on inputs, poultry litter is the dominant source of phosphorus in the watershed. 10:43AM
Q All right. Is there anything else in your knowledge, experience that you rely on in making that opinion besides this Table 2?
MS. LONGWELL: Object to form. 10:43AM
A Other litter from this watershed and other watersheds and published journals and reports from others.
Q All right. Let's talk a little bit about some terminology. Are you familiar with the term surface runoff and -- well, let me just ask that. Are you familiar with that term? 10:44AM
A Yes.
Q In a hydrologic concept, can you tell the court what that means? 10:44AM
A What it means is when it rains, part of the precipitation travels through the soil surface or land surface, and that is primarily the surface runoff. It can also represent some of the water that travels partially through the subsurface but 10:44AM

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Education

Ph.D., Oklahoma State University (Biosystems Engineering)

M.S., University of Arkansas (Biological & Agricultural Engineering)

B.S., University of Allahabad, India (Agricultural Engineering)

Research Interests

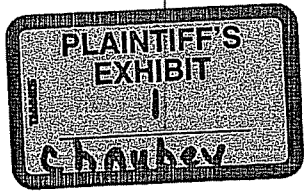
Ecohydrology, solute and sediment transport at various spatial/temporal scales, development and assessment of best management practices to minimize nonpoint source pollution, spatial variability of natural processes that control hydrologic/water quality watershed response, effect of land use on sediment, nutrient and metal transport, interaction of terrestrial and aquatic processes affecting water quality and linking these processes to develop integrated watershed/water quality management technology, mathematical modeling of sediment, nutrients and metals at different spatial scales, and application of geographic information systems and remote sensing in developing decision support system for ecosystem management.

Awards/Honors Appointment/Elections

- Outstanding Engineer Award (2006)
- Faculty Research Award of Merit (2006)
- ASAE Honorable Mention Paper Award
- Best Teacher Award, 2005. Biological Engineering Student Club, University of Arkansas.
- Outstanding Researcher Award (2002- 2003) Department of Biological and Agricultural Engineering. University of Arkansas, Fayetteville.

Professional Experience

- Chair, Arkansas Section of the ASABE. 2004-2005.
- Chair, SW-21 (Hydrology Group). 2005-2006.



- Member, Environmental Task Force, CAFLS and the Division of Agriculture, University of Arkansas. 2002 – 2006. I was selected by the University of Arkansas Division of Agriculture to take a leadership role (with Dr. T.C. Daniel) in developing this computer software to prepare nutrient management plan for animal waste management in the Eucha-Spavinaw watershed.
- Chair, Graduate Committee, Department of Biological and Agricultural Engineering, University of Arkansas. 2005 – 2006. As the Chair of this committee, I had taken a leadership role in developing policy for qualifying examination and candidacy examination for Ph.D. students, and criteria for deficiency courses for students admitted in the program without an engineering degree. In addition, the graduate committee oversaw the graduate curriculum and all graduate admissions in the department.
- Ecological Engineering Committee, Department of Biological and Agricultural Engineering, 2002 – 2006. Chair, 2000-2003.
- Academic Matters and Curriculum Committee, Department of Biological and Agricultural Engineering, 2002 – 2006. Worked with other faculty members to prepare ABET materials. This involved extensive review of course materials, educational outcome assessment, and document preparation. Worked with other faculty members to revise BENG curriculum, including review of credit hours required for degree in BSBE, review of required and elective courses, sequencing of course offerings, and revision of some of the course materials (e.g., BENG 4903: Natural Resources Engineering).

Publications

- **Chaubey, I.** D. Sahoo, B.E. Haggard, M.D. Matlock, and T.A. Costello. 2007. Nutrient retention, limitation, and sediment interactions in a pasture dominated stream. *Transactions of the ASAE. In Print.*
- Migliaccio, K.W. and **I. Chaubey**. 2007. Multi-site and multi-variable calibration and validation of watershed models – discussion. *Journal of Hydrological Processes. In Print.*
- Sudheer, K.P., **I. Chaubey**, V. Garg, and K.W. Migliaccio. 2007. Impact of time scale of calibration objective function on the performance of watershed models. *Journal of Hydrological Processes. In Print.*
- **Chaubey, I.** and M. Matlock. 2007. Teaching undergraduate students to manage aquatic ecosystems at the watershed level: an ecological engineering approach. *International Journal of Engineering Education.* In Print.
- Sen1, S., B.E. Haggard, **I. Chaubey**, K.R. Brye, T.A. Costello, and M.D. Matlock. 2007. Sediment phosphorus release at Beaver Reservoir, northwest Arkansas, 2002-3. *Air, Soil, and Water Pollution 179:67-77.*

- Migliaccio, K.W., **I. Chaubey**, and B.E. Haggard. 2007. Evaluation of landscape and instream modeling to predict watershed nutrient yields. *Environmental Modeling and Software 22(7): 987-999*
- Sudheer, K.P., **I. Chaubey**, and V. Garg. 2006. Lake water quality assessment from Landsat TM data using neural network: An approach to optimal band combination selection. *Journal of the American Water Resources Association 42(6):1683-1695.*
- Yuan, Y., R.L. Bingner, and **I. Chaubey**. 2006. Phosphorus modeling in the Annualized Agricultural Nonpoint Source Pollution (AnnAGNPS) Model. *In Modeling Phosphorus in the Environment, D.E. Radcliffe, and M.L. Cabrera (ed.). CRC Press, Boca Raton, FL.* Pp. 215-240.
- Chaubey, I., K.L. White, C.H. Green, J.G. Arnold, and R. Srinivasan. 2006. Phosphorus Modeling in Soil and Water Assessment Tool Model. *In Modeling Phosphorus in the Environment, D.E. Radcliffe, and M.L. Cabrera (ed.). CRC Press, Boca Raton, FL.* Pp. 163-188
- **Chaubey, I.** and G.M. Ward. 2006. Hydrologic budget analysis of a small natural wetland in southeastern USA. *Journal of Environmental Informatics 8(1):10-21.*
- Shirmohammadi, A., **I. Chaubey**, R.D. Harmel, D.D. Bosch, R. Munoz-Carpena, C. Dharmasri, A. Sexton, M. Arabi, M.L. Wolfe, J. Frankenberger, C. Graff, and T.M. Sohrabi. 2006. Uncertainty in TMDL models. *Transactions of the ASABE 49(4):1033-1049.*
- Ekka, S.A., B.E. Haggard, M.D. Matlock, and **I. Chaubey**. 2006. Dissolved phosphorus concentrations and sediment interactions in effluent dominated Ozark streams. *Ecological Engineering 26:375-39*
- DeLaune, P.B., B.E. Haggard, T.C. Daniel, **I. Chaubey**, and M.J. Cochran. 2006. The Eucha/Spavinaw Phosphorus Index: A court mandated index for litter management. *Journal of Soil and Water Conservation 61(2):96-105.*

Indrajeet Chaubey

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Unavailability of clean water is one of the grand challenges of modern times. Indrajeet's research integrates field data collection with simulation-based engineering and computational thinking to advance our understanding of fate and transport of water and related constituents across a wide range of spatial and temporal scales. Specifically, he is interested in ecohydrologic processes affecting fate and transport of sediment, nutrients, and pesticides from various land use activities and developing watershed management strategies to improve water quality.

Selected Publications

Chaubey, I. D. Sahoo, B.E. Haggard, M.D. Matlock, and T.A. Costello. 2007. Nutrient retention, limitation, and sediment interactions in a pasture dominated stream. Transactions of the ASABE. 50(1): 35-44.

Sudheer, K.P., **I. Chaubey**, V. Garg, and K.W. Migliaccio. 2007. Impact of time scale of calibration objective function on the performance of watershed models. Journal of Hydrological Processes. 21(25): 3409-3419

Sen, S., B.E. Haggard, **I. Chaubey**, K.R. Brye, T.A. Costello, and M.D. Matlock. 2007. Sediment phosphorus release at Beaver Reservoir, northwest Arkansas, 2002-3. Air, Soil, and Water Pollution 179:67-77

Migliaccio1, K.W., **I. Chaubey**, and B.E. Haggard. 2007. Evaluation of landscape and instream modeling to predict watershed nutrient yields. Environmental Modeling and Software 22(7): 987-999.

Sudheer, K.P., **I. Chaubey**, and V. Garg. 2006. Lake water quality assessment from Landsat TM data using neural network: An approach to optimal band combination selection. Journal of the American Water Resources Association 42(6):1683-1695.